

Application No. 10/580,699
Paper Dated: November 5, 2009
In Reply to USPTO Correspondence of July 14, 2009
Attorney Docket No. 1217-061625

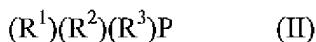
AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims

Claim 1 (Currently Amended): A process for producing a phosphonium borate compound, which comprises the following steps 1 and 2:

(step 1) reacting a phosphine with HCl to produce a phosphine hydrochloride, the phosphine being represented by Formula (II):



wherein R¹ is a primary alkyl group of 1 to 20 carbon atoms, a secondary alkyl group of 3 to 20 carbon atoms, a tertiary alkyl group of 4 to 20 carbon atoms, or a cycloalkyl group of 3 to 20 carbon atoms;

R² is a hydrogen atom, a primary alkyl group of 1 to 20 carbon atoms, a secondary alkyl group of 3 to 20 carbon atoms, a tertiary alkyl group of 4 to 20 carbon atoms, a cycloalkyl group of 3 to 20 carbon atoms, an aralkyl group of 7 to 20 carbon atoms, or an allyl group of 3 to 20 carbon atoms;

R³ is a hydrogen atom, a primary alkyl group of 1 to 20 carbon atoms, a secondary alkyl group of 3 to 20 carbon atoms, a tertiary alkyl group of 4 to 20 carbon atoms, a cycloalkyl group of 3 to 20 carbon atoms, an aryl group of 6 to 30 carbon atoms, an aralkyl group of 7 to 20 carbon atoms, an alkenyl group of 2 to 20 carbon atoms, an alkynyl group of 2 to 20 carbon atoms, or an allyl group of 3 to 20 carbon atoms; and

R¹, R² and R³ may be the same or different from one another;

the phosphine hydrochloride being represented by Formula (III):



wherein R¹, R² and R³ are as defined in Formula (II);

and

(step 2) reacting the phosphine hydrochloride with a tetraarylborate compound represented by Formula (IV):



wherein M is lithium, sodium, potassium, magnesium halide or calcium halide, and Ar is an aryl group of 6 to 20 carbon atoms;

the phosphonium borate compound being represented by Formula (I):

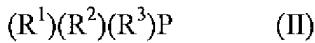


wherein R¹, R² and R³ are as defined in Formula (II), and Ar is as defined in Formula (IV);

wherein step 1 is conducted in the absence of the tetraaryl borate compound used in step 2 and wherein the solution of the phosphine hydrochloride obtained in step 1 and provided for step 2 is not subjected to concentration.

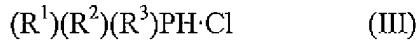
Claim 2 (Currently Amended): A process for producing a trialkylphosphonium tetraphenylborate according to claim 1, which comprises the following steps 1 and 2:

(step 1) reacting a trialkylphosphine with HCl to produce a trialkylphosphine hydrochloride, the trialkylphosphine being represented by Formula (II):



wherein R¹, R² and R³ are ethyl, n-butyl, tert-butyl or cyclohexyl groups, and are the same;

the trialkylphosphine hydrochloride being represented by Formula (III):



wherein R¹, R² and R³ are as defined in Formula (II);

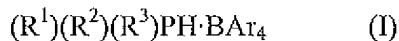
and

(step 2) reacting the trialkylphosphine hydrochloride with a tetraphenylborate compound represented by Formula (IV):



wherein M is lithium, sodium, potassium, magnesium halide or calcium halide, and Ar is phenyl group;

the trialkylphosphonium tetraphenylborate being represented by Formula (I):

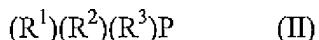


wherein R¹, R² and R³ are as defined in Formula (II), and Ar is as defined in Formula (IV);

wherein step 1 is conducted in the absence of the tetraaryl borate compound used in step 2 and wherein the solution of the phosphine hydrochloride obtained in step 1 and provided for step 2 is not subjected to concentration.

Claim 3 (Currently Amended): A process for producing a novel phosphonium borate compound according to claim 1, which comprises the following steps 1 and 2:

(step 1) reacting a phosphine with HCl to produce a phosphine hydrochloride, the phosphine being represented by Formula (II):



wherein R¹ is a secondary alkyl group of 3 to 20 carbon atoms, a tertiary alkyl group of 4 to 20 carbon atoms, or a cycloalkyl group of 3 to 20 carbon atoms;

R² is a hydrogen atom, a primary alkyl group of 1 to 20 carbon atoms, a secondary alkyl group of 3 to 20 carbon atoms, a tertiary alkyl group of 4 to 20 carbon atoms, a cycloalkyl group of 3 to 20 carbon atoms, an aralkyl group of 7 to 20 carbon atoms, or an allyl group of 3 to 20 carbon atoms;

R³ is a hydrogen atom, a primary alkyl group of 1 to 20 carbon atoms, a secondary alkyl group of 3 to 20 carbon atoms, a tertiary alkyl group of 4 to 20 carbon atoms, a cycloalkyl group of 3 to 20 carbon atoms, an aryl group of 6 to 30 carbon atoms, an aralkyl group of 7 to 20 carbon atoms, an alkenyl group of 2 to 20 carbon atoms, an alkynyl group of 2 to 20 carbon atoms, or an allyl group of 3 to 20 carbon atoms; and

R¹, R² and R³ may be the same or different from one another;

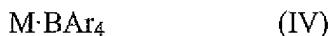
the phosphine hydrochloride being represented by Formula (III):



wherein R¹, R² and R³ are as defined in Formula (II);

and

(step 2) reacting the phosphine hydrochloride with a tetraarylborate compound represented by Formula (IV):



wherein M is lithium, sodium, potassium, magnesium halide or calcium halide, and Ar is an aryl group of 6 to 20 carbon atoms;

the phosphonium borate compound being represented by Formula (I):



wherein R¹, R² and R³ are as defined in Formula (II), Ar is as defined in Formula (IV), R¹, R² and R³ cannot be tert-butyl groups simultaneously and Ar cannot be phenyl group at the same time, and R¹, R² and R³ cannot be cyclohexyl groups

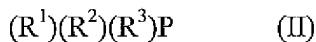
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simultaneously and Ar cannot be phenyl group at the same time;

wherein step 1 is conducted in the absence of the tetraaryl borate compound used in step 2 and wherein the solution of the phosphine hydrochloride obtained in step 1 and provided for step 2 is not subjected to concentration.

Claim 4 (Currently Amended): A process for producing a phosphonium borate compound, which comprises the following steps 1 and 2:

(step 1) reacting a phosphine with H₂SO₄ to produce a phosphine sulfate, the phosphine being represented by Formula (II):



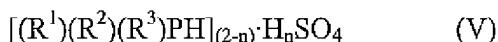
wherein R¹ is a primary alkyl group of 1 to 20 carbon atoms, a secondary alkyl group of 3 to 20 carbon atoms, a tertiary alkyl group of 4 to 20 carbon atoms, or a cycloalkyl group of 3 to 20 carbon atoms;

R² is a hydrogen atom, a primary alkyl group of 1 to 20 carbon atoms, a secondary alkyl group of 3 to 20 carbon atoms, a tertiary alkyl group of 4 to 20 carbon atoms, a cycloalkyl group of 3 to 20 carbon atoms, an aralkyl group of 7 to 20 carbon atoms, or an allyl group of 3 to 20 carbon atoms;

R³ is a hydrogen atom, a primary alkyl group of 1 to 20 carbon atoms, a secondary alkyl group of 3 to 20 carbon atoms, a tertiary alkyl group of 4 to 20 carbon atoms, a cycloalkyl group of 3 to 20 carbon atoms, an aryl group of 6 to 30 carbon atoms, an aralkyl group of 7 to 20 carbon atoms, an alkenyl group of 2 to 20 carbon atoms, an alkynyl group of 2 to 20 carbon atoms, or an allyl group of 3 to 20 carbon atoms; and

R¹, R² and R³ may be the same or different from one another;

the phosphine sulfate being represented by Formula (V):



wherein R¹, R² and R³ are as defined in Formula (II), and n is an integer of 0 or 1;

and

(step 2) reacting the phosphine sulfate with a tetraarylborate compound represented by Formula (IV):



wherein M is lithium, sodium, potassium, magnesium halide or calcium

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halide, and Ar is an aryl group of 6 to 20 carbon atoms;

the phosphonium borate compound being represented by Formula (I):

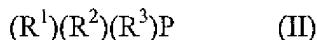


wherein R¹, R² and R³ are as defined in Formula (II), and Ar is as defined in Formula (IV);

wherein step 1 is conducted in the absence of the tetraaryl borate compound used in step 2 and wherein the solution of the phosphine sulfate obtained in step 1 and provided for step 2 is not subjected to concentration.

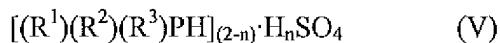
Claim 5 (Currently Amended): A process for producing a trialkylphosphonium tetraphenylborate according to claim 4, which comprises the following steps 1 and 2:

(step 1) reacting a trialkylphosphine with H₂SO₄ to produce a trialkylphosphine sulfate, the trialkylphosphine being represented by Formula (II):



wherein R¹, R² and R³ are ethyl, n-butyl, tert-butyl or cyclohexyl groups, and are the same;

the trialkylphosphine sulfate being represented by Formula (V):



wherein R¹, R² and R³ are as defined in Formula (II), and n is an integer of 0 or 1;

and

(step 2) reacting the trialkylphosphine sulfate with a tetraphenylborate compound represented by Formula (IV):



wherein M is lithium, sodium, potassium, magnesium halide or calcium halide, and Ar is phenyl group;

the trialkylphosphonium tetraphenylborate being represented by Formula (I):



wherein R¹, R² and R³ are as defined in Formula (II), and Ar is as defined in Formula (IV);

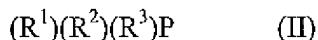
wherein step 1 is conducted in the absence of the tetraaryl borate compound

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used in step 2 and wherein the solution of the phosphine sulfate obtained in step 1 and provided for step 2 is not subjected to concentration.

Claim 6 (Currently Amended): A process for producing a novel phosphonium borate compound according to claim 4, which comprises the following steps 1 and 2:

(step 1) reacting a phosphine with H₂SO₄ to produce a phosphine sulfate, the phosphine being represented by Formula (II):



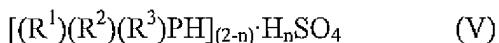
wherein R¹ is a secondary alkyl group of 3 to 20 carbon atoms, a tertiary alkyl group of 4 to 20 carbon atoms, or a cycloalkyl group of 3 to 20 carbon atoms;

R² is a hydrogen atom, a primary alkyl group of 1 to 20 carbon atoms, a secondary alkyl group of 3 to 20 carbon atoms, a tertiary alkyl group of 4 to 20 carbon atoms, a cycloalkyl group of 3 to 20 carbon atoms, an aralkyl group of 7 to 20 carbon atoms, or an allyl group of 3 to 20 carbon atoms;

R³ is a hydrogen atom, a primary alkyl group of 1 to 20 carbon atoms, a secondary alkyl group of 3 to 20 carbon atoms, a tertiary alkyl group of 4 to 20 carbon atoms, a cycloalkyl group of 3 to 20 carbon atoms, an aryl group of 6 to 30 carbon atoms, an aralkyl group of 7 to 20 carbon atoms, an alkenyl group of 2 to 20 carbon atoms, an alkynyl group of 2 to 20 carbon atoms, or an allyl group of 3 to 20 carbon atoms; and

R¹, R² and R³ may be the same or different from one another;

the phosphine sulfate being represented by Formula (V):



wherein R¹, R² and R³ are as defined in Formula (II), and n is an integer of 0 or 1;

and

(step 2) reacting the phosphine sulfate with a tetraarylborate compound represented by Formula (IV):



wherein M is lithium, sodium, potassium, magnesium halide or calcium halide, and Ar is an aryl group of 6 to 20 carbon atoms;

the phosphonium borate compound being represented by Formula (I):



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wherein R¹, R² and R³ are as defined in Formula (II), Ar is as defined in Formula (IV), R¹, R² and R³ cannot be tert-butyl groups simultaneously and Ar cannot be phenyl group at the same time, and R¹, R² and R³ cannot be cyclohexyl groups simultaneously and Ar cannot be phenyl group at the same time;

wherein step 1 is conducted in the absence of the tetraaryl borate compound used in step 2 and wherein the solution of the phosphine sulfate obtained in step 1 and provided for step 2 is not subjected to concentration.